CLAIMS

We claim:

1. A method of diagnosing individuals at risk for a disease state comprising

a) determining the distribution of Rad51 foci in a first tissue type of a first individual; and

b) comparing said distribution to the distribution of Rad51 foci from a second normal tissue type from said first individual or a second unaffected individual;

wherein a difference in said distributions indicates that the first individual is at risk for a disease state which results in aberrant Rad51 loci.

2. A method according to claim 1 wherein said disease state is cancer.

3. A method of diagnosing individuals at risk for cancer comprising

a) determining the distribution of Rad51 foci in a potential cancerous tissue type of a first individual; and

b) comparing said distribution to the distribution of Rad51 foci from a second normal tissue type from said first individual or a second unaffected individual;

wherein a difference in said distributions indicates that the first individual is at risk for a cancer which results in aberrant Rad51 loci.

4. A method according to claim 3 wherein the cancer is selected from breast cancer and skin cancer.

5. A method of diagnosing individuals at risk for a disease state associated with apoptosis, said method comprising

a) determining the distribution of Rad51 foci in a first tissue type of a first individual; and

b) comparing said distribution to the distribution of Rad51 foci from a second normal tissue type from said first individual or a second unaffected individual;

wherein a difference in said distributions indicates that the first individual is at risk for a disease state associated with apoptosis which results in aberrant Rad51 loci.

6. A method according to claim 1 wherein the extent of aberrent distribution indicates the severity of the disease state.

7. A method according to claim 1 wherein said distribution is determined through the use of polyclonal antibodies.

8. A method according to claim 1 wherein said distribution is determined through the use of monoclonal antibodies.

9. A method according to claim 7 or 8 wherein said antibodies are raised against eukaryotic Rad51.

10. A method according to claim 9 wherein said eukaryotic Rad51 is mammalian Rad51.

11. A method for identifying an apoptotic cell comprising

a) determining the distribution of Rad51 foci in a first cell; and

b) comparing said distribution to the distribution of Rad51 foci from a second non-apoptotic cell;

wherein a difference in said distributions indicates that the first cell is apoptotic.

12. A method according to claim 11 wherein said distribution is the association of Rad51 with DNA fibers.

13. A method according to claim 11 wherein said distribution is the association of Rad51 into micronuclei.

14. A method for identifying a cell under stress associated with nucleic acid modification comprising

a) determining the distribution of Rad51 foci in a first cell; and

b) comparing said distribution to the distribution of Rad51 foci from a second non-affected cell;

wherein a difference in said distributions indicates that the first cell is under stress associated with nucleic acid modification.

15. A method according to claim 14 wherein said stress is oxidative or hypoxic stress.

16. A method according to claim 14 wherein said stress is heat shock.

17. A method according to claim 14 wherein said stress is cold shock.

18. A method for identifying a cell containing a mutant Rad51 gene comprising determining the sequence of all or part of at least one of the endogenous Rad51 genes.

19. A method of identifying the Rad51 genotype of an individual comprising determining all or part of the sequence of at least one Rad51 gene of said individual.

20. A method according to claim 18 or 19 further comprising comparing the sequence of said Rad51 gene to a known Rad51 gene.

21. A method according to claim 20 wherein a difference in the sequence between the Rad51 gene of said individual and said known Rad51 gene is indicative of a disease state or a propensity for a disease state.

22. A method for screening for a bioactive agent capable of binding to Rad51 comprising:

a) adding a candidate bioactive agent to a sample of Rad51; and

b) determining the binding of said candidate agent to said Rad51.

23. A method for screening for a bioactive agent capable of modulating the activity of Rad51, said method comprising the steps of:

a) adding a candidate bioactive agent to a sample of Rad51; and

b) determining an alteration in the biological activity of Rad51.

24. A method according to claim 23 wherein said biological activity is DNA dependent ATPase activity.

25. A method according to claim 23 wherein said biological activity is nucleic acid strand exchange.

26. A method according to claim 23 wherein said biological activity is DNA binding.

27. A method according to claim 23 wherein said biological activity is filament formation.

28. A method according to claim 23 wherein said biological activity is DNA pairing.

29. A method for screening for a bioactive agent capable of modulating the activity of Rad51, said method comprising the steps of:

a) adding a candidate bioactive agent to a cell; and

b) determining the effect on the formation or distribution of Rad51 foci in said cell.

30. A method according to claim 25 further comprising subjecting said cell to conditions which induce nucleic acid damage.

31. A method of inducing apoptosis in a cell comprising increasing the activity of Rad51 in said cell.

32. A method according to claim 31 wherein said increasing comprises overexpression of endogenous Rad51.

33. A method according to claim 31 wherein said increasing comprises administration of a gene encoding Rad51.

34. A method according to claim 31 wherein said increasing comprises administration of Rad51 protein.

35. A method according to claim 31 wherein said cell is a cancer cell.

36. A method according to claim 31 further comprising subjecting said cell to conditions which induce nucleic acid damage.

37. A method according to claim 36 wherein said conditions comprise the administration of a chemical agent which causes nucleic acid damage.

38. A method according to claim 36 wherein said conditions comprise subjecting said cell to radiation.

39. A method according to claim 31 further comprising increasing the activity of p53 in said cell.

40. A composition comprising:

a) nucleic acid encoding a Rad51 protein; and

b) nucleic acid encoding a tumor suppressor protein.

41. A composition according to claim 38 wherein said tumor suppressor protein is p53.

42. A composition according to claim 38 wherein said tumor suppressor protein is BRCA1.

43. A composition according to claim 38 wherein said tumor suppressor protein is BRCA2.

44. A composition according to claim 38 comprising:

a) nucleic acid encoding a Rad51 protein;

b) nucleic acid encoding a BRCA1 protein;

c) nucleic acid encoding a BRCA2 protein; and

d) nucleic acid encoding a p53 protein.

45. A composition comprising:

a) a recombinant Rad51 protein; and

b) a recombinant tumor suppressor protein.

46. A kit for detecting the distribution of Rad51 foci in a cell or tissue comprising:

a) binding agent for Rad51 foci; and

b) a detectable label.

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